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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No. 9812
Ronald D. Blum	Examiner: BOECKMANN, Jason J.
Application No.: 09/994,860	Technology Center/Art Unit: 3752
Filed: November 28, 2001	APPELLANTS' BRIEF UNDER 37 CFR §41.37
For: METHOD AND APPARATUS FOR REDUCING THE INTENSITY OF HURRICANES AT SEA BY DEEP-WATER UPWELLING	

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
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Sir:

Further to the Notice of Appeal filed April 15, 2010 for the above-referenced application, and in reply to the Final Rejection mailed December 15, 2009, Appellants submit this Brief on Appeal.

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1. REAL PARTY IN INTEREST

The real party in interest for this appeal and the present application is The Egg Factory, LLC, , by way of an Assignment recorded in the U.S. Patent and Trademark Office at Reel 012549, Frame 0715.

2. RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings, known to Appellant, Appellant's representative, or the Assignee, that may be related to, or that will directly affect or be directly affected by or have a bearing upon, the Board's decision in the pending appeal. Appellants' previous appeal in this matter, filed October 15, 2008 and assigned Appeal Number 2009-9570, was returned from appeal without decision by the Board on September 10, 2009 pursuant to Appellants' Request for Continued Examination filed September 3, 2009.

3. STATUS OF CLAIMS

Claims 1-17 and 33-37 are on appeal.

Claims 1-17 and 33-37 are pending.

No claims are allowed, and no claims are objected to only for being dependent from a rejected base claim, but are otherwise allowable.

Claims 1-17 and 33-37 are rejected.

Claim 37 is withdrawn from consideration.

Claims 18-32 are canceled.

4. STATUS OF AMENDMENTS

No Amendment After Final Rejection has been filed in response to the December 15, 2009 Final Rejection. The claims stand as amended by Appellants' September 3, 2009 Amendment.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 is directed to a method of making a reduced intensity hurricane, comprising: positioning a plurality of submersibles (*e.g.* ¶¶ [0064], [0070], Figs. 11-16, elements 1108, 1200, 1402, 1502, and 1600) in a hurricane interception area (*e.g.* ¶ [0030], Fig. 1, element 12), the hurricane interception area describing an area of ocean through which at least a portion of the hurricane's central core will pass (*e.g.* ¶¶ [0026] and [0030], Figs. 1 and 6, element 16); maneuvering the plurality of submersibles to a depth (*e.g.* ¶ [0030], Figs. 1 and 11, element 16); maintaining the plurality of submersibles in the hurricane interception area at the depth for a period of time (*e.g.* ¶ [0030]); and releasing a gas from the plurality of submersibles after the plurality of submersibles have entered the hurricane interception area (*e.g.* ¶ [0030], Fig. 1, elements 18 and 20), the gas being released during the period of time, the gas forming bubbles which rise in a plume toward a surface of the ocean (*e.g.* ¶ [0030], Fig. 1, element 18), the plume entraining water from at least the depth and upwelling the entrained water toward the surface of the ocean to cool the surface of the ocean (*e.g.* ¶¶ [0026], [0031]-[0032], [0040]-[0041], [0052]-[0053], and [0067], Fig. 1, element 12), the cooled surface reducing the intensity of the hurricane whose portion of central core passes through the hurricane interception area (*e.g.* ¶¶ [0005], [0052], Figs. 2-6).

Claim 2 is directed to the method of claim 1, wherein the depth is greater than the depth of a thermocline below the surface of the ocean in the hurricane interception area (*e.g.* ¶ [0030], Figs. 1 and 11).

Claim 3 is directed to the method of claim 1, wherein the period of time is in the range of about 3 to about 24 hours (*e.g.* ¶ [0031]).

Claim 4 is directed to the method of claim 1, wherein the entrained water is upwelled at a rate, such that the total amount of upwelled water achieves a sea surface temperature reduction (*e.g.* ¶¶ [0051]-[0053]).

Claim 5 is directed to the method of claim 1, wherein a required cross track dimension of the interception area is substantially one half of the diameter of the hurricane's central core (*e.g.* ¶¶ [0026], [0030] and [0061]-[0071], Figs. 4-6).

Claim 7 is directed to the method of claim 1, wherein the bubbles are formed at a diameter and rise from a release surface of a cross-sectional area (*e.g.* ¶ [0076]).

Claim 8 is directed to method of reducing the intensity of a hurricane, comprising: staging a plurality of mobile submersibles (*e.g.* ¶¶ [0064], [0070], Figs. 11-16, elements 1108, 1200, 1402, 1502, and 1600) in an interception area (*e.g.* ¶ [0030], Fig. 1, element 12) around a forecast hurricane position, the plurality of mobile submersibles distributed across a first distribution area comparable to a mean position forecast error of the forecast hurricane position (*e.g.* ¶¶ [0026] and [0030], Figs. 1 and 3 and 5); reducing, in accordance with a reduced mean position forecast error as the hurricane approaches the plurality of mobile submersibles, the first distribution area of the plurality of mobile submersibles to a second distribution area(*e.g.* ¶¶ [0026], [0030], and [0055], Figs. 3 and 5, element 16); and generating, after the step of reducing, at least one bubble plume from at least one of the plurality of mobile submersibles (*e.g.* ¶ [0030], Fig. 1, element 18), the at least one bubble plume upwelling water from a depth to a surface of the ocean, the upwelled water cooling the surface of the ocean (*e.g.* ¶¶ [0026], [0031]-[0032], [0040]-[0041], [0052]-[0053], and [0067], Fig. 1, element 12), the cooled ocean surface reducing the intensity of the hurricane (*e.g.* ¶¶ [0005], [0052], Figs.3 and 5).

Claim 9 is directed to the method of claim 8, wherein the second distribution area is an area between about 30% to about 100% of the size of the hurricane's central core (*e.g.* Figs. 3 and 5).

Claim 10 is directed to the method of claim 8, wherein the depth is greater than the depth of a thermocline below the surface of the ocean in the predetermined area (*e.g.* ¶ [0030], Figs. 1 and 11).

Claim 11 is directed to the method of claim 8, wherein the bubble plume comprises bubbles formed at a diameter and rising from a release surface of a cross-sectional area (*e.g.* ¶ [0076]).

Claim 12 is directed to the method of claim 8, wherein the upwelled water is upwelled at a rate, such that the total amount of upwelled water achieves a sea surface temperature reduction (*e.g.* ¶¶ [0051]-[0053]).

Claim 14 is directed to a method of reducing the intensity of a hurricane, comprising: positioning a plurality of submersibles (*e.g.* ¶¶ [0064], [0070], Figs. 11-16, elements 1108, 1200, 1402, 1502, and 1600) below an ocean's surface in an area of the ocean above which at least a portion of the hurricane's central core will pass (*e.g.* ¶¶ [0026] and [0030], Figs. 1 and 6, element 16), the ocean's surface having a sea surface temperature; generating at least one bubble plume from the plurality of submersibles (*e.g.* ¶ [0030], Fig. 1, element 18); and upwelling water by action of the at least one bubble plume, wherein the water is upwelled at a rate such that the total amount of upwelled water achieves a sea surface temperature reduction at the conclusion of a period of time (*e.g.* ¶¶ [0005] , [0026], [0031]-[0032], [0040]-[0041], [0052]-[0053], and [0067], Fig. 1, element 12).

Claim 15 is directed to the method of claim 14, wherein the plurality of submersibles are positioned below the ocean's surface at a depth greater than the depth of a thermocline (*e.g.* ¶ [0030], Figs. 1 and 11).

Claim 16 is directed to the method of claim 14, wherein the portion of the hurricane's central core is between about 30% to about 100% of the size of the hurricane's central core (*e.g.* Figs. 4-6).

Claim 17 is directed to the method of claim 14, wherein the period of time is in the range of about 3 to about 24 hours (*e.g.* ¶ [0031]).

Claim 33 is directed to the method of claim 1, wherein the submersibles are stationary submersibles (*e.g.* ¶¶ [0045], [0047], and [0049]-[005], Figs. 2 and 4).

Claim 34 is directed to the method of claim 1, wherein the submersibles are mobile submersibles (*e.g.* ¶¶ [0026], [0030], [0034], Figs. 3, 5, and 11-16, elements 1108, 1200, and 1502).

Claim 35 is directed to the method of claim 14, wherein the submersibles are stationary submersibles (*e.g.* ¶¶ [0045], [0047], and [0049]-[005], Figs. 2 and 4).

Claim 36 is directed to the method of claim 14, wherein the submersibles are mobile submersibles (*e.g.* ¶¶ [0026], [0030], [0034], Figs. 3, 5, and 11-16, elements 1108, 1200, and 1502).

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are presented for review:

1) Claims 1-17 and 33-36 are rejected as lacking utility under 35 U.S.C. §101;

2) Claims 1-17 and 33-36 are rejected as non-enabled under 35 U.S.C. §112, first paragraph.

7. ARGUMENT

The Office Action rejects claims 1-17 and 33-36 under 35 U.S.C. §101 "because the disclosed invention is wholly inoperative and therefore lacking credible utility." Office Action at page 3. The Office Action rejects claims 1-17 and 33-36 under 35 U.S.C. §112, first paragraph, "as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected to make and/or use the invention." Office Action at page 5. However, the Office Action misapplies the law relating to utility and enablement, and improperly rejects evidence, including expert Declarations and documentary evidence, that establish the utility and enablement of the claimed subject matter. Proper application of the law, in consideration of Appellants' disclosure and the additional evidence submitted, demonstrates that the present subject matter meets the standard for utility and is sufficiently enabled to one of ordinary skill in the art.

A. CLAIM REJECTIONS 35 U.S.C. § 101

The Office Action rejects claims 1-17 and 33-36 under 35 U.S.C. § 101 "because the disclosed invention is wholly inoperative and therefore lacking credible utility." Office Action at page 3. In support of this rejection, the Office Action (1) misapplies the relevant law regarding utility, (2) follows a pattern of reasoning expressly discourage by the MPEP, (3) fails to meet the requisite evidentiary basis to substantiate a rejection, and (4) fails to give the required deference to the written disclosure.

1. Reasoning Expressly Discouraged By The MPEP

As an initial matter, the Office Action contends "the application does not contain sufficient information to permit a person of ordinary skill in the art to believe that the process disclosed… could achieve the asserted useful result, since applicant has shown no evidence of reducing the speculation and conjecture to practice…" Office Action, page 4. However, the "speculation and conjecture" label attributed to the asserted utility is a rejection rationale

expressly discouraged by the MPEP. "Office personnel should be careful not to label certain types of invention as 'speculative' as such labels do not provide the correct focus for the evaluation of an assertion utility… A conclusion that an asserted utility is incredible can be reached only after the Office has evaluated both the assertion of the applicant regarding utility and any evidentiary basis of that assertion." MPEP § 2107.02 (III B). As discussed further below, the Office Action fails to properly consider the assertions of the specification along with the evidence of record. Therefore, in labeling the asserted utility as speculation prior to a proper analysis of the evidence, the Office Action utilizes the exact conclusion-first rationale the MPEP expressly discourages.

2. No *Prima Facie* Showing For Lack Of Credible Utility

To properly reject a claimed invention under 35 U.S.C. §101, the Office must (A) make a *prima facie* showing that the claimed invention lacks utility and (B) provide a sufficient evidentiary basis for factual assumptions relied upon in establishing the *prima facie* showing. MPEP §2107.02(IV) (emphasis added). Whenever possible, the examiner should provide documentary evidence regardless of publication date (*e.g.*, scientific or technical journals, excerpts from treatises or books, or U.S. or foreign patents) to support the factual basis for the *prima facie* showing of no specific and substantial credible utility. If documentary evidence is not available, the examiner should specifically explain the scientific basis for his or her factual conclusions. *Id*. (emphasis added).

The Office Action attempts to assert that "the application does not contain sufficient information to permit a person of ordinary skill in the art to believe that the process disclosed… could achieve the asserted useful result, since applicant has shown no evidence of reducing the speculation and conjecture to practice...", Office Action at page 4, however it is well-settled that patent applicants need not provide evidence of either conception or actual reduction to practice when relying on the content of the patent application. *Hyatt v. Boone*, 146 F.3d 1348, 1352, 47 USPQ2d 1128, 1130 (Fed. Cir. 1998). The MPEP only requires it be more likely than not that the asserted utility would be credible to a person of ordinary skill in the art. MPEP

§2107.02(VI). The utilization of an erroneous legal standard cannot establish a *prima facie* showing for lack of credible utility.

In asserting that the present subject matter is allegedly inoperative and, therefore, lacks utility, the Office Action fails to support the conclusion with the requisite evidentiary basis or scientific reasoning. For example, the Office Action broadly asserts that "taking into consideration the enormous size of a hurricane, the process of modifying a hurricane disclosed by applicant would take more than the resources realistically available to mankind." Office Action at page 4. Such statements, unsupported by any specific facts or scientific principles, do not meet the standard for establishing a *prima facie* showing of inoperability.

Moreover, an assertion of utility is credible unless (A) the logic underlying the assertion is seriously flawed, or (B) the facts upon which the assertion is based are inconsistent with the logic underlying the assertion. MPEP §2107.02(III)(B). The Office Action does not challenge the logic of Appellants' asserted utility, but rather appears to object to the scale of the invention.

The Office Action apparently relies on *Brenner v. Manson*, 148 USPQ 689 (U.S. 1966), in support of the claim that the present subject matter lacks credible utility. *Brenner* addressed a situation in which a new method for producing a chemical composition was found to lack utility because there was no demonstrated use for the chemical composition. *Brenner* at 695. On the contrary, the present subject matter is directed to methods for reducing the intensity of hurricanes. This objective is obviously and unquestionably "useful" within the context of *Brenner*. Moreover, Appellants have met the relevant standard for operability as well.

The relevant standard for inoperability, as set forth in *CFMT v. Yieldup*, 68 USPQ 2d 1940 (Fed. Cir. 2003), "applies primarily to claims with impossible limitations." *CFMT* at 1944. For example, in *Process Control Corp. v. HydReclaim Corp.*, 52 USPQ2d 1029 (Fed. Cir. 1999) the court found the claims inoperable because they required violating the principle of conservation of mass. Likewise, in *Newman v. Quigg*, 11 USPQ2d 1340 (Fed. Cir. 1989) claims to a "perpetual motion machine" were found inoperable. The present subject matter is not analogous to these inoperable inventions with "impossible limitations." As argued extensively throughout prosecution of this application, attested to by expert Declarations, and demonstrated further below, the invention of reducing the intensity of a hurricane by cooling the water over

which the hurricane passes does not violate a law of physics or fall in the category of impossible perpetual motion machines. Rather, the fundamental principles upon which Appellants rely are accepted in the relevant fields (such as hurricane intensity reducing when passing over sufficiently cool water) or demonstrated in scientific testing and modeling (such as the ability to cool the surface of water by upwelling colder water by gas bubble plumes).

3. Lack Of Evidentiary Basis To Question A Fact Of The Disclosure

Appellants assert facts in the disclosure describing how to calculate the total volume of upwelled water that would reduce the intensity of a hurricane. *See* Appln at ¶¶ [0040]-[0053]. However, in an analysis of the Rondorf Declaration, the Office Action contends "Rondorf is only calculating the number of submersibles required to provide the amount of upwelling that is mentioned in the specification, not the amount of gas required to… reduce the intensity of, or form a reduced intensity hurricane." (Ex. Ans. 1/9/2009 Page 8). It appears that the logic of this statement only holds if the Office Action is questioning whether "the amount of upwelling that is mentioned in the specification" would actually reduce the intensity of a hurricane. (Ex. Ans. 1/9/2009 Page 8). Thus, the Office Action questions the exact facts presented in the disclosure.

"Office personnel are reminded that they must treat as true a statement of fact made by an applicant in relation to an asserted utility, unless countervailing evidence can be provided that shows that one of ordinary skill in the art would have a legitimate basis to doubt the credibility of such a statement." MPEP §2107(II)(emphasis added). Again, the Office Action has provided no evidence to substantiate the rejections and relies solely on cursory opinions and conclusions. As such, the Office Action has no basis to question the veracity of the disclosure. Due to the Office Action's lack of corroborating evidence and the ample evidence presented supporting the facts of the disclosure, including three expert declarations and the numerous publications and patents, one of ordinary skill in the art would have no legitimate basis to doubt the credibility of the facts asserted.

4. Other Support For Utility

Although the Office Action has provided no supporting documentary evidence to establish a *prima facie* showing for lack of credible utility , Appellants have further rebutted the

unsupported opinions and conclusions by providing peer-reviewed scientific journal articles, U.S. patents, and U.S. patent applications in support of credible utility.

Whenever possible, the examiner should provide documentary evidence regardless of publication date (*e.g.*, scientific or technical journals, excerpts from treatises or books, or U.S. or foreign patents) to support the factual basis for the *prima facie* showing of no specific and substantial credible utility. MPEP §2107.02(IV)(emphasis added). In this case, rather than the examiner presenting evidence of no specific and substantial credible utility, the evidence of record all points toward a finding of credible utility. For example, Appellants respectfully submit that the sixteen published applications and patents, along with thirteen publications cited in the July 24, 2009 IDS are further evidence to the utility of the claimed invention, i.e., reducing the intensity of a hurricane is possible and conforms with accepted scientific principles.

The cited references are related to products and/or methods for modulating weather. These references provide evidence that (i) technologies exist for altering weather and (ii) reputable and independent scientific groups are interested in developing these technologies in order to alter weather, *i.e.*, those of skill in the art recognize the utility of weather altering methods. For example, the Dyn-O-Mat Company has developed and patented (U.S. Patent No. 6,315,213) an absorbent polymer product, known as Dyn-O-Gel, which has been shown to downsize storms and has the potential of reducing a hurricane. *See* U.S. Patent No. 6,316,213, column 2, lines 32-35. The polymer is used to seed a storm cloud, where Dyn-O-Gel is capable of absorbing many times its weight of water molecules in order to reduce the intensity of storms. *See Id.* at column 1, line 65 – column 2, line 5 and column 2, lines 32-35.

In addition, Atmocean, Inc.TM has developed a wave-driven ocean upwelling system. *See* Atmocean Inc., "Atmocean," pages 1, http://www.atmocean.com. The system is located in the open ocean and functions to pump deep ocean water to the ocean surface thereby cooling the upper ocean, See *Id.* The upwelling system may be used to downsize hurricanes. *See* Atmocean Inc., "Downsizing Hurricanes Using Atmocean's Upwelling System," pages 1, http://www.atmocean.com/hurricane_intensity.htm. Specifically, mathematical modeling outlining the placement of the upwelling arrays at a certain depth and location shows the

lowering of the upper ocean temperature by a few degrees C, thereby reducing winds by up to 15% and reducing the overall damages by up to 40%. *See Id.*

Moreover, Appellants submitted several research articles specifically directed to methods for reducing hurricane intensity published in peer-reviewed journals. For example, Rosenfield et al. provides evidence that particular methods that cool the environment surrounding a hurricane, i.e., seeding-induced evaporative cooling, can reduce the overall strength of a hurricane. *See* Rosenfeld, D. et al., "Simulation of Hurricane Response to Suppression of Warm Rain by Sub-Micron Aerosols," Atmos. Chem. Phys., April 5, 2007, pages 3411-3424, vol. 7, Copernicus Publications on behalf of the European Geosciences Union.

Additionally, LaRosa describes suppression of hurricane intensity and even the possibility of preventing hurricanes by reducing sea surface temperature:

> "The author believes that sea surface cooling merits consideration by the oceanographic, marine, environmental, maritime, offshore, and many other sciences and industries, as well as politicians, the public, insurance companies, financial institutions, and others This paper has concentrated on the technical feasibility of providing enough sea-surface cooling to actually improve the hurricane statistics." *See* LaRosa, Richard, "Hurricane Suppression by Sea Surface Cooling," May 5, 2006, pages 1-5, IEEE.

Finally, several scientific organizations, including Searete, a company with reputable inventors such as Mr. William (Bill) Gates, have recently filed multiple patent applications with the asserted utility of reducing the intensity of hurricanes. For example, one of Searete's six cited applications, U.S. Pub. No. 2009/0173386, for which Mr. Gates is listed as an inventor, is directed towards moving surface water to lower depths via wave induced downwelling in order to reduce hurricane intensity. *See* U.S. Pub. No. 2009/0173386, paragraph [0008]. The specification discloses a vessel as a tub-like structure with walls, where, when the floating on the ocean surface, the walls stretch to a level above the ocean surface. *See Id.* at paragraph [0036]. The vessel also comprises buoyancy tanks and a conduit, a tube like structure at the bottom of the tub that extends well below the ocean surface. *See Id.* at paragraph [0034]. As waves overlap the top of the vessel walls, the water level within the tub rises to a level higher than the ocean surface. *See Id.* at paragraph [0036]. The water level difference creates a pressure head

that pushes surface water down through the conduit to relatively deeper ocean depths. *See Id.* at paragraph [0036].

This trend towards increased publications and patents filings by reputable scientific groups is evidence that weather modification is considered a credible utility by those skilled in the art. In addition, the participation of renowned inventors, such as Bill Gates, shows the field has garnered the interest of major technological players and stands to gain substantial attention in the near future. The investment of capital and resources is a strong indication that those in the art find hurricane mitigation a viable option and see it as providing a credible utility.

The Office Action questions whether the claimed upwelling process would in fact mitigate the strength of a hurricane. In addition to the arguments presented above, Appellants further submit that the allowance of Patent No. 7,520,237 demonstrates that the USPTO has found a similar hurricane mitigation disclosure as possessing a credible utility. The allowed patent utilizes a buoyant platform affixed to a wind-driven power source that powers a water-moving system and water-dispensing system. *See* Patent No. 7,520,237, column 1, lines 59-65. The water system pumps deeper cooler water to the surface in order to lower the surface water temperature and mitigate hurricane intensity. *See Id.* at column 1, lines 53-59. The allowed patent is silent, however, regarding the detailed calculations for determining a volume of cool water upwelling necessary to achieve hurricane mitigation. When compared side-by-side, Appellants' disclosure establishes a greater showing for credible utility since it does contain the calculations to determine a volume of cool water upwelling that would accomplish hurricane mitigation, *See* Appln at ¶¶ [0040]-[0053].

5. The Office Action Disregards Relevant Publications

Despite the evidence bolstering the conclusions of the previously submitted expert Declarations and claimed subject matter, the Response to Arguments in the revised First Action Final Rejection mailed December 15, 2009 states, in its entirety:

> Applicant's arguments filed 9/3/2009 have been fully considered but they are not persuasive.

> Regarding the applicant's arguments concerning the 35 U.S.C. 101 and 112 1st paragraph rejections, the applicant uses various prior U.S. applications and U.S. patents to support and justify that the present invention meets the requirements of 35 U.S.C. 101 and 112 1st paragraph. However, the examiner is not at liberty to comment on the previous work of other examiners or the Patent office as a whole.

This response fails to adequately consider Appellants' arguments and cited references.

First, the Office Action does not address the credibility of the sixteen published applications and patents, or the thirteen publications, at all. This is particularly inappropriate in the context of the current 101 and 112 rejections, in which the Examiner broadly asserts, without evidentiary support, not only that the claimed subject matter lacks credible utility, but also that the sworn Declarations of three experts in support of the claims are insufficient.

Second, the non-response that "the examiner is not at liberty to comment on the previous work of other examiners or the Patent office as a whole" does not even attempt to address the non-patent publications that Appellants submitted. Thus, Appellants are unsure how the Office Action may justify disregarding the relevance of these references with respect to whether one of ordinary skill in the art would have believed that the claimed subject matter has credible utility.

Third, Appellants submit that the work of the "Patent office as a whole" is certainly relevant to the credible utility of an application. The MPEP instructs the Examiner to "provide documentary evidence regardless of publication date (*e.g.*, scientific or technical journals, excerpts from treatises or books, or U.S. or foreign patents) to support the factual basis for the *prima facie* showing of no specific and substantial credible utility." MPEP §2107.02(IV). As such, the Examiner is to provide his or her own U.S. patent evidence and, if none is presented, is to at least analyze and comment on U.S. patent evidence provided by the Appellants. The non-response position taken in the Office Action displays, at a minimum, an inappropriate disregard for the instructions of the MPEP.

Appellants' specification asserts the credible utility of the claimed subject matter. These claims have been attested to be expert declarations. The numerous peer reviewed scientific journal publications, U.S. patents, and U.S. patent applications show a significant trend toward

developing the technology of hurricane mitigation. A community of inventors has been motivated by the devastating consequences of high strength hurricanes and has taken steps toward making various hurricane reduction, and other weather mitigation techniques, a reality. A position by the Patent Office that technologies directed toward hurricane mitigation lack credible utility would be contrary to the direction of innovation in this field, potentially undercutting the strong efforts and progress in an area of intense public need, and, finally, would be contrary to the Patent Office's mandate to promote the progress of the sciences and useful arts. Appellants respectfully submit that the credible utility of the claimed subject matter has been established by the evidence of record, and that the Office Action has not overcome this evidence by any objective showing. Therefore, the rejection must be withdrawn.

Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §101 rejections to independent claims 1, 8, and 14 and their dependent claims 2-7, 9-13, 15-17, and 33-36.

B. CLAIM REJECTIONS 35 U.S.C. § 112 First Paragraph

1. No *Prima Facie* Showing For Lack Of Enablement

The Office rejects claims 1-17 and 33-36 under, 35 U.S.C. § 112, first paragraph as containing subject matter that was not described in the specification in such a way as to enable one of skill in the art to which it pertains, or with which it is most nearly connected to make and/or use the invention. Office Action at page 5.

The Office Action presupposes that one of skill in the art would not know how to use the claimed invention. The presupposition is based on the Office Action's asserted lack of credible utility for the invention. However, as shown above by the Singleton Declaration, the Ginis Declaration, and the Rondorf Declaration, and the numerous other documents regarding hurricane mitigation, Appellants assert that the utility of the claimed invention is credible.

It appears the Office Action goes on to questions whether the enablement requirement is met by the disclosure independent of credible utility. In support of this rejection, the Office Action (1) misapplies the relevant law regarding enablement and (2) fails to meet the requisite standard for undue experimentation.

2. The Office Action Utilizes An Erroneous Legal Standard

The Office Action questions whether the enablement requirement is met by the specification. The standard for determining whether the specification meets the enablement requirement may be determined by asking whether the experimentation needed to practice the invention is undue or unreasonable. As in the case of the utility rejection, the Office Action again appears to consider the scale of the invention to make it *per se* not enabled. This is not the legal standard.

The amount of experimentation to practice the full scope of the claimed invention is not dispositive, particularly when the experimentation is routine, *i.e.* when the techniques necessary

to do so were well known to those skilled in the art. *See, e.g.*, *Ex parte Kubin*, 83 USPQ2d 1410 (Bd. Pat. App. & Int. 2007), *citing Johns Hopkins Univ. v. Cellpro, Inc.*, 152 F.3d 1342, 1360, 47 USPQ2d 1705, 1719 (Fed. Cir. 1998). Appellants disclosure provides considerable direction and guidance to enable one skilled in art to implement the invention in a straight forward manner using technology that existed prior to 2001 as evidenced in the Rule 132 Declarations.

3. The Disclosure Provides Adequate Guidance To Practice The Claims

The specification supports the claims and provides numerous examples of implementations of the invention as claimed. The Office Action provided Appellants with only one example of why it asserted that the claims were not supported by the specification in exact terms. The Office Action expresses concern over "the grand scale or vast area of the release site." Office Action at page 5. The specification addresses this issue in its discussion of the amount of water required for upwelling. The calculation provided in the specification is given for the most intense Atlantic hurricane as of the filing date of the application, namely, Hurricane Gilbert. The exemplary calculation was based on a region to be cooled being a circle having a radius of 90 km or only about 56 miles. *See* Appln. ¶ at 0043. In another embodiment, the region of the area to be cooled is an area equal to about half the size of the central core. *See* Appln, at ¶¶ 0061-64. It is noted that on of about September 14, 2004, the category five hurricane Ivan in the Caribbean Ocean has a core of about 30 miles. This would leave a region to be cooled on the order of only about 15 miles. No evidence has been presented to demonstrate that the worst case scenario presented as an exemplary calculation in the specification, or the present real world example of hurricane Ivan, presents a release site that is of such a grand scale or vast area as to be unreasonable for practical application of the claimed invention. The specification therefore feasibly supports the use of the invention to reduce the intensity of hurricanes.

The Office Action also expresses concern over the amount of gas required to affect a hurricane. The specification provides an example of the amount of gas that may be required to upwell a given quantity of water in intercepting a single storm as being approximately 687

million Nm^3. *See* Appln at ¶ 0102. Again, no evidence has been presented that this would be unreasonable for use in a practical application of the claimed invention. Furthermore, Appellants have submitted the Singleton Declaration. In her Declaration, Ms. Singleton conducted numeric modeling using known bubble plume models and the information in the specification to calculate the amount of gas required for upwelling. (Singleton Declaration, ¶8).

The Office Action also expresses concern over the number of submersibles required for the process. The number of submersibles is not defined by the specification, but given the equations provided for calculation of upwelling volume of water and examples of the amount of gas required to produce such an upwelling, one of ordinary skill in the art could calculate the number of submersibles needed based on the gas volume storage capability of each submersible. The art of submarine manufacture is well established in countries such as the United States, Great Britain, and the former Soviet Union.

In addition to the disclosure, Appellants have submitted the Rondorf Declaration, that provides support that the type and number of submersibles needed for implementing the claimed invention may readily ascertained by using the amount of direction provided for in the specification and the knowledge of one skilled in the art. (Rondorf Declaration, ¶5). CAPT Rondorf states that submarines may be converted to a gas carrying capacity by two methods, (i) modifying existing submarine hulls and (ii) cutting the submarine in half and inserting a new section specific for the desired use. (¶¶8-9). As an alternative to modifying existing submarine hulls, CAPT Rondorf states that a towed submersible body may be readily constructed to carry and release the gas required for upwelling. (¶10).

The Office Action does not establish that the mechanics or techniques of validating the claimed invention would have been difficult to understand to one of ordinary skill in the art or would require undue or unreasonable experimentation.

4. No Established Need For Undue Experimentation

Page 6 of the Office Action attempts to assert a number of rationales in support of the rejection under 35 U.S.C. §112, First Paragraph. However, a cursory review of the various

rationales demonstrates that they suffer from many of the same flaws addressed above, and do not support a finding of lack of enablement under the proper legal standard. For example, whether the "claimed invention is broad and sweeping in scope" or the "nature of the invention is a large-scale environment change" does not support a finding of lack of enablement when Appellants have clearly described numerous embodiments that demonstrate how someone of ordinary skill in the art could go about practicing the invention, and provided expert declarations showing that the invention may be practiced without undue experimentation, based on the disclosure of the specification. In this regard, the Office Action is unclear regarding what exactly would be undue experimentation about implementing the described embodiments. As in the case of the utility rejection, the Office Action again appears to consider the scale of the invention to make it *per se* not enabled. This is not the legal standard.

The scale of the implementation needed does not violate enablement and does not establish undue experimentation. Appellants assert that sufficient detail is provided in the form of well reasoned interception strategies and calculations of upwelling volumes required for each strategy as supported by the Rule 132 Declarations.

Additionally, Appellants specifically disagree with the assertions that the "level of one ordinary skill in the art is best characterized as that of a theoretical scientist dealing in probabilities and possibilities rather than that of an engineer dealing in practical applications of technology" and that the "outcome of the disclosed concept is entirely unpredictable." Office Action at page 6. On the contrary, the experts who provided Declarations in support of the enablement of Appellants' disclosure are not merely "theoretical scientist dealing in probabilities and possibilities" and each demonstrate in their respective Declarations how one of ordinary skill in the art could take Appellants' disclosure and implement the specific teachings contained therein. Computer models implemented, for example, by Dr. Ginis and Ms. Singleton clearly demonstrate that the disclosed methods are not "entirely unpredictable." Also, someone seeking a submersible having specified capabilities that are achievable with straightforward modifications to existing submersibles would likely not turn to a "theoretical scientist," but rather to an engineer with expertise relating to submersibles.

Finally, the assertion that the "quantity of experimentation needed to use the invention based on the content of the disclosure can only be characterized as astronomical considering the lack of background information, past experiment, and specific detail" is simply not true. Office Action at page 6. Appellants have fully complied with their duty of describing the invention in a way that someone of ordinary skill in the art could practice the invention, given enough resources. This would not require as astronomical amount of experimentation to reduce the intensity of a hurricane.

The weight of the evidence as a whole establishes the credible utility and enablement of the present subject matter, notwithstanding the Office Action's piecemeal challenges and rhetorical flourishes to the contrary.

C. Expert Declarations

1. Cooling Sea Surface Temperature Can Reduce The Intensity Of Hurricanes

Appellants have asserted facts in the disclosure of the application that show that reduction of sea surface temperatures can reduce the intensity of hurricanes. The disclosure contains sufficient evidence and reasoning to permit a person of ordinary skill in the art to believe the asserted utility. For example:

> [0005] Because tropical storms draw their energy from the heat content of the upper ocean, it is generally accepted that a large area of cooled ocean surface can suppress hurricane intensity. Numerical modeling studies at the Massachusetts Institute of Technology suggests that reduction of sea surface temperature by 2.5°C in the storm's central core would eliminate the thermodynamic conditions that sustain hurricanes. Other numerical model studies by independent researchers corroborate these results. In addition, analyses of measurements from past hurricanes show a strong correlation between lack of hurricane intensification and conditions that favor cold-water upwelling by the storm's own winds, such as a shallow thermocline or slow forward speed. Finally, there is clear evidence that hurricanes weaken (or do not intensify under otherwise favorable conditions) when a hurricane crosses the cold "wake" of a previous storm.
>
> * * *

> [0007] The physics of natural and artificial hurricane intensity control appear to be governed by sea surface temperature (SST) and the thermal structure (density stratification) of the upper ocean. These influences are combined into a single parameter, Hurricane Heat Potential (HHP), which is used by meteorologists to quantify the heat energy in the upper ocean that is available to fuel a tropical storm. Since SSTs less than 26°C typically cannot support hurricane development, HHP is defined as the heat content in excess of 26°C typically per unit area of the underlying water column between the sea surface and the depth of the thermocline. All such excess heat in this layer of water can be readily mixed from top to bottom by hurricane winds and is thus available to fuel the storm's atmospheric convection. A discussion of the scientific basis for hurricane intensity control, which includes discussions on: formation, development, and features of tropical storm systems; natural processes that limit hurricane intensity; and sea surface temperature and hurricane heat potential; and the definition of hurricane interception regions may be found in section 2.0 of Provisional Application Serial Number 60/253,111 filed November 28, 2000 titled "Method and Apparatus for-Reducing the Intensity of Hurricanes at Sea by Deep-Water Upwelling." [incorporated by reference in its entirety]

In addition to the disclosure described below, Appellants have submitted the Ginis Declaration, which provides support that reduction of sea surface temperatures can reduce the intensity of hurricanes. Dr. Ginis attests that he is a leading expert in numerical modeling and forecasting of sea-air interaction during hurricanes. (Ginis Declaration, ¶1). Furthermore, he has published over 70 papers in scientific journals and books on this topic. (¶1). Dr. Ginis attests that the effect of air-sea interaction as a negative feedback on tropical cyclone development and intensity is well established. (¶8).

Specifically, Dr. Ginis states that the effect of air-sea interaction as a negative feedback on tropical cyclone development and intensity has been well established. (¶8). It is known that strong surface winds in a tropical cyclone induce turbulent mixing in the upper ocean and entrainment of the underlying cold water into the ocean mixed layer, which cools and deepens. (¶8). Both observational and real case numerical studies showed that the SST anomalies induced by tropical cyclones can reach up to 5-6°C. (¶8). Studies also showed that tropical cyclone intensity is more sensitive to the local SST changes under the hurricane core than to those beyond the core area. (¶8). Therefore, it can be expected that cooling of the ocean area underneath the hurricane core can reduce its intensity. (¶8).

Furthermore, Dr. Ginis conducted two numerical modeling studies, the 2°C swath experiment and the 1°C swath experiment, that suggest that a reduction of sea surface temperature by 2.5°C in the storm's central core would eliminate the conditions that sustain hurricanes. (¶9). In the modeling studies, the hurricane intensity was reduced after the storm encountered the cooled regions. (¶15). The maximum winds were reduced from about 145 kts to about 135 kts (6% reduction) in the 1°C swath experiment and to about 130 kts (10% reduction) in the 2°C swath experiment. (¶15).

2. The Ginnis Declaration

The Examiner has alleged that the Ginnis Declaration is insufficient to overcome the rejection of claims 1-17 and 33-36 based upon 35 U.S.C. §101 and 35 U.S.C. §112, first paragraph. The Appellants disagree.

For example, the Examiner challenges the Ginis Declaration as "merely shows numerical modeling of how reduction of sea surface temperature by 2.5 degrees would affect a numerical model of a hurricane.. [which] does not address the rejections at hand." (Ex. Ans. 1/9/2009 Page 8). This is an oversimplification and mischaracterization of the Ginis Declaration as a whole.

As discussed below, the Singleton Declaration provides sufficient evidence to establish that the artificial upwelling of the deep, cold seawater to the sea surface layer by the bubble-driven plume would create an upper ocean layer region of sufficiently lower temperature.

Appellants submitted the Ginis Declaration to evidence that the effect of air-sea interaction as a negative feedback on tropical cyclone development and intensity has been well established and that tropical cyclones experience a noticeable reduction of intensity owing to their coupling with the ocean. In his declaration, Dr. Ginis demonstrated by numerical experiments that when a hurricane encounters cooler water surface temperatures, *e.g.*, 1°C and 2°C, the wind strength of the hurricane was reduced. Specifically, Dr. Ginis stated:

> The temperature anomalies (SSTA) underneath the hurricane core, defined as a circular area around the storm center with R=100 km, are shown in Figure 3. The SSTA are greatly reduced when the

> hurricane crosses the cooled regions. Evolution of hurricane central pressure and maximum winds in the numerical experiments are shown in Figure 4. In both sensitivity experiments the hurricane intensity was reduced after the storm encounters the cooled regions. The maximum winds were reduced from about 145 kts to about 135 kts (6% reduction) in the 1°C swath experiment and to about 130 kts (10% reduction) in the 2°C swath experiment.

Ginis Declaration at para. 16.

> I conducted an additional experiment in which the size of the 2°C cooled region was doubled along the track direction. As result, the hurricane intensity was further reduced from about 145 kts to about 120 kts (22% reduction). These sensitivity experiments clearly indicate that both the size and magnitude of the cooled area encountered by a moving hurricane make important impact on the hurricane intensity reduction.

Id. at para. 17.

3. Bubble-Plume Dynamics Can Cool Sea Surface Temperature

Next, the pending application describes how to calculate the total volume of upwelling water, required to weaken a major hurricane. *See* Appln at ¶¶ [0040]-[0053]. Note especially the equation given in paragraph [0052], which provides one of skill in the art with the fraction, f, of the total interception area volume that must be replaced by upwelling water in order to achieve a final layer temperature of 26°C in accordance with the example provided.

In addition to the description in the disclosure, Appellants have submitted the Singleton Declaration which provides support that one of ordinary skill in the art using the amount of direction provided for in the specification in combination with the knowledge of one skilled in the art is able to calculate the total volume of upwelling water and total volume of gas required that would create an upper ocean area of sufficiently lower temperature. Specifically, in her Declaration, Ms. Singleton attests that she holds a Master of Science in Civil Engineering, specializing in bubble plume dynamics and is currently a 4th year Ph.D. candidate studying bubble plume dynamics. (Singleton Declaration, ¶1). Ms. Singleton has provided as Exhibits A-

F to her Declaration a copy of references directed to bubble plume dynamics and artificial upwelling to create cooler upper layer water areas of cooler temperature. (¶6).

In order to calculate an estimate of the gas flow rate required to induce an adequate upwelling flow rate, Ms. Singleton applied to existing bubble-plume models. The bubble-plume models are based upon the references attached as Exhibits A-F. (¶6). In order to apply the models, Ms. Singleton used profile data collected off the eastern coast of Florida on September 19, 2007 to determine boundary condition profiles of temperature and water salinity. (¶7). Using the boundary conditions, Ms. Singleton ran each model over a range of applied gas flow rates to a single diffuser system or unit to arrive at the plume water flow rates, which represent the upwelling flow rate from deeper water into the effective epilimnion. (¶8). Ms. Singleton further attests that it would be expected that the artificial upwelling of the deep, cold seawater to the sea surface later by the bubble-driven plume would create an upper ocean layer region of sufficiently lower temperature. (¶8). Finally, Ms. Singleton has calculated the total volume of liquid CO_2 required for the upwelling using the model estimated water flow rate values for linear and circular diffusers to be 1×10^8 m^3 and 1.3×10^8 m^3 for linear and circular diffusers, respectively. (¶9). While the total amount of CO_2 is different than the volume of gas disclosed in the application, it is within a range accounted for by the different assumptions by Ms. Singleton, i.e., depth of the thermocline and geography of the area. In any event, the volumes of CO_2 required are still within reason and operable.

4. The Singleton Declaration

The Examiner has alleged that the Singleton Declaration is insufficient to overcome the rejection of claims 1-17 and 33-36 based upon 35 U.S.C. §101 and 35 U.S.C. §112, first paragraph. The Appellants disagree.

Specifically, the Examiner has alleged that the "present invention does not use the exact methods or diffusers that are being used in Ms. Singleton's calculations." (Ex. Ans. 1/9/2009 Page 9). There is no requirement that Ms. Singleton use the exact methods or diffusers as disclosed in the claimed invention. The MPEP only requires that the Examiner compare the

methods used in the experiments of the declaration with the methods disclosed in the application. The experiments in the declaration merely need to use the guidance in the specification as filed and must correlate to the scope of the claimed invention. Specifically, for example, MPEP §2164.05 states:

> [H]owever, the examiner should carefully compare the steps, materials, and conditions used in the experiments of the declaration with those disclosed in the application to make sure that they are commensurate in scope; i.e., that the experiments used the guidance in the specification as filed and what was well known to one of skill in the art. Such a showing also must be commensurate with the scope of the claimed invention, *i.e.,* must bear a reasonable correlation to the scope of the claim (emphasis added).

It is clear in Ms. Singleton's declaration that she used the disclosure as a guide to arrive at her estimate of the gas flow rate and the quantity of gas required to lower the temperature of the sea surface. Specifically, Ms. Singleton stated:

> [T]his declaration provides support for an initial order-of-magnitude estimate of the gas flow rate and the quantity of gas required to induce an adequate upwelling flow rate to lower the temperature of the upper sea surface, using the amount of direction provided for in the specification in combination with the knowledge of one skilled in the art at the time of filing the application, such as the use of two existing bubble-plume models.
>
> Singleton Declaration at para. 5.
>
> Based upon the design example in the patent application, it was assumed that the diffusers would be located at about 300 m depth when bubbling. The patent application states that carbon dioxide is the preferred gas, so model calculations focus on this compound.
>
> *Id.* at para. 6.

Furthermore, the experimental models provided in her declaration certainly have more than a reasonable correlation to the scope of the claims (i.e., independent claim 1 recites "…the gas being released during the period of time, the gas forming bubbles which rise in a plume toward a surface of the ocean, the plume entraining water from at least the-depth and upwelling

the entrained water toward the surface of the ocean to cool the surface of the ocean…"). Specifically, Ms. Singleton stated:

> Using these initial and boundary conditions, each model was run over a range of applied gas flow rates (2,000–20,000 Nm^3/s) to a single diffuser system or unit. Because the intent of the apparatus is to cool surface waters, the lowest gas flow rate that upwelled water to and detrained at the surface was selected. The gas flow rates that induced plumes to the surface were 10,500 and 12,500 Nm^3/s for the linear and circular diffusers, respectively. The depth of the 26°C isotherm, the temperature below which hurricane development is hampered, was 81 m. Therefore, only plume induced flow rates from 300 to 81 m depth are considered as effective upwelling flow rates. For the previously stated gas flow rates, the plume water flow rates at the depth of 26°C isotherm are 51,900 and 51,300 m^3/s for a single linear and circular diffuser, respectively. These flow rates represent the upwelling flow rate from deeper water into the effective epilimnion or surface layer. Even though the plume continues to rise through the epilimnion and entrain ambient water, plume induced flow that occurs within the effective epilimnion does not contribute to the upwelling into this volume. <u>It would be expected that the artificial upwelling of the deep, cold seawater to the sea surface layer by the bubble-driven plume would create an upper ocean layer region of sufficiently lower temperature.</u>
>
> *Id.* at para. 8. (emphasis added).

The Examiner has also alleged that "the applicants even go as far to admit, that the bubble plume methods of their invention have never been used in open-ocean," concluding that "if that is truly the case, then the calculation of Ms. Singleton cannot properly be used to model the present invention." (Ex. Ans. 1/9/2009 Page 9). Again, the Appellants disagree. First, there is no requirement that an applicant have physically implemented the invention prior to the filing date. Specifically, the MPEP at §2164.02 states:

> An applicant need not have actually reduced the invention to practice prior to filing…The Court held that "The mere fact that something has not previously been done clearly is not, in itself, a sufficient basis for rejection all applications purporting to disclose how to do it."

Secondly, the Examiner's conclusion that Ms. Singleton's calculations cannot properly be used to model the present invention is incorrect. There is no requirement that Ms. Singleton "prove how upwelling water at a rate of 12.1 million m^3/s will reduce the intensity of a hurricane." (Ex. Ans. 1/9/2009 Page 9). According to MPEP §2164.03 states:

> The "predictability or lack thereof" in the art refers to the ability of one skilled in the art to extrapolate the disclosed or known results to the claimed invention. If one skilled in the art can readily anticipate the effect of a change within the subject matter to which the claimed invention pertains, then there is predictability in the art.

In her declaration, Ms. Singleton modified two well-known existing bubble-plume models so the models would be applicable to open-ocean conditions. For example, Ms. Singleton states:

> Because they [the models] are used for lake oxygenation studies, the solubility (Weiss, R. ET AL., Mar. Chem. 1974, 2, 203-215) and mass transfer coefficients (Clift, R., ET AL., BUBBLE, DROPS, AND PARTICLES New York, NY, 1978) of the bubble-plume models were modified for carbon dioxide, and the effect of dissolved carbon dioxide on water density was included (Weiss ET AL, *supra*).
>
> Singleton Declaration at para. 6. (emphasis added).

In her declaration Ms. Singleton stated that the artificial upwelling of the deep, cold seawater to the sea surface layer by the bubble-driven plume would create an upper ocean layer region of sufficiently lower temperature based upon her own calculations combined with the knowledge generally known in the art. *See e.g., Id.* at para. 8. Therefore, since Ms. Singleton was able to readily extrapolate the disclosed results of the claimed invention, there is predictability in the art.

Finally, the Examiner has alleged that Ms. Singleton calculates that "each submersible would need to have approximately 12 diffusers connected to its outer shell," concluding that the "specification appears to only have support for each submersible having a single diffuser." (Ex. Ans. 1/9/2009 Pages 9-10). The Examiner's allegation is inaccurate. The specification discloses

several examples illustrating the number of diffusers that may be mounted on the submersibles. *See e.g.,* Figs. 13-16 of the specification. Notwithstanding,

> [A]s long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of claim, then the enablement requirement of 35 U.S.C. § 112 is satisfied.
>
> MPEP §2164.01(b)

It is clear from Ms. Singleton's declaration that the number of diffusers needed for one particular implementation of the claimed invention were readily ascertained by using the amount of direction provided for in the specification and the knowledge of one skilled in the art without any undue experimentation thereby satisfying the enablement requirement of 35 U.S.C. §112, first paragraph.

5. Submersibles Can Achieve Bubble-Plume Dynamics

Additionally, the application presents four well-reasoned descriptions of how submersibles could achieve the upwelling required to reduce the intensity of the hurricane: 1) submersibles maneuvering while upwelling (*see* Appln at ¶¶ [0054]-[0057]); 2) submersibles maneuvering before upwelling (*see* Appln at ¶¶ [0058]-[0060]); 3) stationary submersibles upwelling (*see* Appln at ¶¶ [0049]-[0053]) and 4) submersibles targeting half of the storm central core (*see* Appln at ¶¶ [0061]-[0064]). Each of the four methods are presented to illustrate the impact of the method on the total upwelling rate required to reduce the intensity of a hurricane. Values of the volume of water to be upwelled are calculated and presented for examination and comparison.

In addition to the disclosure, Appellants have submitted the Rondorf Declaration which provides support that the type and number of submersibles required for implementing the claimed invention may be readily ascertained by using the amount of directed provided for in the specification. In the Rondorf Declaration, CAPT Rondorf attests that he is the Assistant Vice President of Science Applications International Corporation headquartered in McLean, Virginia. (Rondorf Declaration, ¶1). Furthermore, CAPT Rondorf has over 25 years of management and

technical engineering of Navy programs including extensive submarine and shipboard operations, Commanding Officer of US Submarine SSN 708, and Integrated Undersea Surveillance System programs. Significantly, CAPT Rondorf is experienced in both submarine construction and renovation. (¶7).

CAPT Rondorf attests that, based on his experience, and construction methods available on or before November 28, 2001, the filing date of the pending application, the modification of existing submarine hulls or construction of a towed body to carry and release a desired amount of gas to produce the upwelling was well within both design and industrial capacity and could have been implemented in a straight forward manner. (¶7).

CAPT Rondorf describes two methods by which submarines may be converted to gas carrying capacity. The first conversion method is the modification of existing submarine hulls, which he attests is a proven technology that has been executed by the United States industrial capacity. (¶8). The second conversion method involves cutting the submarine hull in half and inserting a new section specific for the desired use. (¶9). CAPT Rondorf attests that this conversion method has been successfully performed by both the United States and Russia. (¶9). As an alternative to converting existing submarine hulls to gas carrying capacity, CAPT Rondorf has described the construction of a towed body to carry and release the gas required for upwelling. (¶10).

Based upon his knowledge of submarines, CAPT Rondorf has calculated the gas carrying capacity of two existing submarines, the U.S. Trident submarine and the Russian Typhoon class submarine. (¶13). CAPT Rondorf estimated for a volume of 687 million Nm^3, the volume of gas disclosed in the application, and estimating that 476 normal cubic meters of gas would be liberated per cubic meter of liquid that 1.4 million m^3 liquid CO_2 would be required. (¶14). Accordingly, in the 500-600 m depths where the submersible payloads would be charged with CO_2, only 19 Typhoon hulls would be required. (¶14).

6. The Rondorf Declaration

The Examiner's Answer asserts that the declaration by "Neil E. Rondorf…is insufficient to overcome the rejections of claims 1-17 and 33-36 based upon 35 U.S.C. 101 and 35 U.S.C. 112, first paragraph as set forth in the last Office Action." (Ex. Ans. 1/9/2009 Page 6). Specifically, the Examiner alleges that "The appellant stated on the record that 'submersibles of the kind required for this application do not presently exist' (page 13, lines9-12), which clearly indicates that at the time of the invention, appellants were not in possession of the technology and resources to make and or use the claimed submersibles" (Ex. Ans. 1/9/2009 Page 8). Appellants disagree.

Indisputably, the specification is replete with examples of submersible payload delivery systems as well as systems that may be retrofitted to implement the claimed invention. The specification specifically states at paragraph [0034]:

> at least three possible types of submersible payload delivery systems are disclosed to implement mobile inception strategies. These embodiments are:
> (1) An all-purpose submersible that comprises gas storage vessels, gas release mechanisms, manifold hoods, ballast tans for buoyancy control, and a submersible maneuvering system, which includes: communications, power supply, propulsion mechanisms, and position/attitude control surfaces.
> (2) A carrier delivery system whereby a dedicated maneuvering submersible has fixed "wings" to carry gas storage and release vessels. The ballast system remains in the maneuvering submersible.
> (3) A towed delivery system whereby a dedicated maneuvering submersible tows a series of gas storage and release submersibles, which contain ballast tanks for buoyancy control as gas is released.

Furthermore, the specification even provides drawings (*i.e.*, Figures 12-15) which illustrate examples of various types of submersibles that could be used to carry out the claimed invention. Specifically, for example, Figure 12 illustrates an "All-Function Submersible," Figure 13 illustrates a "Carrier Delivery Submersible," Figure 14 illustrates an alternative "Carrier Delivery Submersible," and Figure 15 illustrates a "Towing Delivery Submersible." Additionally, the specification provides more than adequate description of these four payload

delivery systems, which may be self-powered, manned or unmanned submersibles. (*See e.g., Id.* at ¶¶ [0104]-[0109]). Indeed, the disclosure sufficiently illustrates that the Appellants were in possession of the technology to make and or use the claimed submersibles.

To further support that the claimed invention complies with the requirements of 35 U.S.C. §112, first paragraph, Appellants submitted the Rondorf Declaration. In his declaration, CAPT Rondorf presented persuasive arguments, supported by suitable proofs, that one skilled in the art would have been able to make and use the invention using the disclosure as a guide. For example, in the Rondorf Declaration, CAPT Rondorf states that the type and number of submersibles needed for implementing the claimed invention could be readily ascertained by using the amount of direction provided for in the specification and the knowledge of one skilled in the art at the time of filing the application without any undue experimentation. *See* Rondorf Declaration at ¶ 5.

In his Declaration, CAPT Rondorf cites several examples of submersibles that have been converted for alternative tasks, such as converting a submersible ballistic missile hull to a submersible ship guided missile hull. CAPT Rondorf provides these examples to demonstrate that the information needed to retrofit an existing submersible or submarine to carry out the claimed invention (i.e., converted to carry and disperse carbon dioxide) would have been known to those of ordinary skill in the art. Specifically, CAPT Rondorf states:

> [H]ere, the missile tubes were converted for use as [a] conventional missile launcher. In addition, inserts were developed to fit inside the former missile tube yielding an alterative mission payload capacity. The converted tubes for alternative payloads are designed to equalize with the pressure of the sea and allow the deployment of the payload with the upper hatch open and no pressure differential. ***Thus, the bubble method for gas release would be very compatible with this operating concept.***

Id. at ¶ 8 (emphasis added). It is irrelevant that the examples of the submersible conversions provided by CAPT Rondorf are not submersibles that can "carry and disperse large amounts of liquid carbon dioxide" as the Examiner asserts. The Rondorf Declaration clearly illustrates that one skilled in the art would have been able to make and use the invention using the disclosure as a guide.

Finally, the Examiner has alleged that "there appears to be a flaw in CAPT Rondorf's reasoning on how many submersibles would be needed in order to carryout the claimed invention," because CAPT Rondorf "bases his calculations on using a Typhoon hull which has a volume of approximately 73,000 cubic meters" rather than the "vessel NR-1 which has an approximately [sic] volume of 32,000 cubic feet (917 cubic meters)." (Ex. Ans. 1/9/2009 Page 7). There is no flaw in CAPT Rondorf's reasoning.

CAPT Rondorf used calculations based upon conversion of a Typhoon hull to gas carrying capacity because this would be the most efficient and logical way of implementing the claimed invention. As he explains in his declaration:

> the United States and Russia have successfully converted submarine hulls from one use to another…Therefore, the conversion of an entire section of a submarine from its original use to a gas release volume is entirely within the capacity of shipyards within the United States and other developed industrial nations. The normal bulkhead construction allows for water tight integrity in each compartment in order to allow the compartment to be isolated in the vent of flooding. Thus this design technique can be used to provide pressure isolation to the proposed gas volume hull section. Using this approach, ***the Typhoon hull form would be the preferred choice for conversion to a gas carrying capacity***.

Id. at ¶ 9 (emphasis added). CAPT Rondorf provides the example of the conversion of the vessel NR-1 merely to show that conversions of submersible from one use to another have been done. Therefore, "the calculations presented on page 5 of the declaration are" not off "by a factor of about 73" as the Examiner alleges. (Ex. Ans. 1/9/2009 Page 8).

7. The Office Action Fails To View The Evidence As A Whole

The claimed invention is based on a combination of features, most generally: (1) generating at least one bubble plume from at least one submersible (2) the at least one bubble plume upwelling water from a depth to a surface of the ocean and cooling the surface of the ocean, and (3) and the cooled ocean surface reducing the intensity of the hurricane. The specification provides enabling description for each of these features. The specification also

discloses combining these features. For example, the specification at [0006] indicates that artificial upwelling of deep, cold seawater is desirable to realize the same hurricane intensity reductions that are predicted by numerical models and observed when hurricanes are exposed to natural cold water upwelling. Similarly, the specification at [0030] discloses the release of gas plumes from submersibles below a thermocline for the purpose of upwelling the colder deep water to reduce the ocean surface temperature. Formulae to calculate the amount of upwelling are provided at paras. [0052] and [0053].

Because the features enumerated above are in different fields of technical endeavor, i.e., (1) submersible construction, (2) bubble plume dynamics, and (3) hurricane dynamics, three different declarations were provided from experts having different expertise. However, the Examiner has taken the position that "the three declarations present facts that are unconnected and do not establish utility or enablement of the claimed subject matter." (Ex. Ans. 1/9/2009 Page 6).

With respect to the Ginis declaration, the Examiner has conceded that "it is understood that if the surface temperature of the ocean in the area that the hurricane [sic] drops 2.5 degrees the hurricane will reduce in intensity." (Ex. Ans. 1/9/2009 Page 7). The Examiner's primary issue with the Ginis declaration appears to be that it does not address how to reduce temperature. (Ex. Ans. 1/9/2009 Page 7). But it is not surprising that the expert in hurricane dynamics provided testimony relating to hurricane dynamics, as opposed to submersible construction or bubble plume dynamics. Nor is it relevant, because enablement of temperature reduction is addressed elsewhere.

With respect to the Rondorf declaration, the Examiner has conceded that the technology to convert existing submarines to carry gas exists. (Ex. Ans. 1/9/2009 Page 7). The Examiner's primary issue with the Rondorf declaration appears that it does not address bubble plume dynamics or how to reduce temperature. (Ex. Ans. 1/9/2009 Page 8). Again, it is not surprising or relevant that the expert in submarine construction provided testimony as to how the specification enables construction of submersibles as opposed to bubble plume dynamics or hurricane dynamics.

With respect to the Singleton declaration, the Examiner has conceded that the declaration "properly calculates the number of linear and circular diffusers needed to upwell at a rate of at least 12.1 million cubic meters per second." (Ex. Ans. 1/9/2009 Page 9). The primary criticisms of the Singleton declaration appear to be that it does not show how such upwelling would reduce ocean temperature by a specific amount, or reduce hurricane intensity. (Ex. Ans. 1/9/2009 Page 9-10). Again, with respect to the later point, it is not required that the expert in bubble plume dynamics address hurricane dynamics. With respect to the former point, the Singleton declaration at para. 8 does establish that surface temperature would be reduced. The specification at para. [0052] provides an undisputed formula establishing a specific amount of temperature reduction based on simple calculations.

In view of the foregoing, it is clear that the Examiner has improperly weighed the evidence of record, including the specification and the Declarations. When viewed as a whole, the evidence of record shows that the Appellants' disclosure establishes the utility and enablement of the claimed subject matter. The specification itself describes the combination of (1) submersibles to generate bubble plumes, (2) the upwelling of cold water by the bubble plumes, and (3) the resultant cooling of the ocean surface and hurricane intensity reduction may be achieved. The Declarations provide unrebutted support showing that each of the elements is enabled by the specification, from an expert having expertise related to each particular element. While no single declaration addresses enablement of all of the claimed features due to diversity in the fields of endeavor to which those features belong, such a declaration is not required. The Declarations taken together provide ample and unrebutted evidence that the claimed subject matter is enabled by the specification and is based on accepted scientific principles.

8. The Examiner Misconstrues "Disinterested Third Party"

The Examiner has previously asserted that the three Rule 132 Declarations submitted on November 5, 2007 are insufficient to overcome the pending rejections. However, the Office Action impermissibly discounts the weight of the evidence as a whole based on specific irrelevant and/or improper bases.

MPEP §2107.02(VII) states that Applicants need not provide evidence such that it establishes an asserted utility as a matter of statistical certainty. *See Nelson v. Bowler*, 626 F.2d 853, 856-57, 206 USPQ 881, 883-84 (CCPA 1980) (reversing the Board and rejecting Bowler's arguments that the evidence of utility was statistically insignificant. The court pointed out that a rigorous correlation is not necessary when the test is reasonably predictive of the response). Instead, evidence will be sufficient if, considered as a whole, it leads a person of ordinary skill in the art to conclude that the asserted utility is more likely than not true.

For example the Examiner has "questions the assertion" whether the three declarants are "disinterested third parties with no financial interest in the assignee" because "they are each receiving $200/hr plus reasonable expenses for his or her time spent on the declaration." (Ex. Ans. 1/9/2009 Page 10). The Office Action therefore concludes that if the declarants are "receiving monetary compensation, there appears to be a financial interest." (Ex. Ans. 1/9/2009 Page 10). This is incorrect.

In determining the probative value of an expert opinion, the general rule is that the Examiner must consider, *inter alia*,

"the interest of the expert ***in the outcome of the case…***"

(MPEP §716.01(c)(III)(emphasis added). Appellants submit that the declarants have no demonstrated interest in the outcome of the pending application and/or a direct financial stake in the success of the patent. In order to determine whether a declarant has an interest in the outcome of the pending application, the courts will look to see if the declarant has any ongoing mutually beneficial relationship with the assignee, such as past or present employment, own stock in assignee's company, or has previously acted as a consultant for assignee's company. *See Ferring B.V. v. Barr Labs., Inc.*, 437 F.3d 1181, 2006 U.S. App. LEXIS 3554 (Fed. Cir., 2006).

As stated in each of the Rule 132 declarations, each of the declarants acted only in the capacity as consultants for the assignee and only received payment that is customary for consultants. Therefore, since none of the declarants have any demonstrated ongoing beneficial relationship with the assignee, the declarants cannot be considered to have a financial interest in the outcome of the case. Moreover, although the interest of the third party should considered by

the Examiner to determine the probative value of the declaration, the declaration cannot be disregarded solely for that reason. *See* MPEP §716.01(c)(III)("[A]n affidavit of an applicant as to the advantages of his or her claimed invention, while less persuasive than that of a disinterested person, cannot be disregarded for this reason alone).

As in the case of utility, Appellants have demonstrated the enablement of the claimed subject matter through reference to the specification, and supported by uncontradicted expert declarations. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §101 and §112 First Paragraph rejections to independent claims 1, 8, and 14 and their dependent claims 2-7, 9-13, 15-17, and 33-36 respectively.

8. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that the rejections are in error and that claims 1-17 and 33-36 are in condition for allowance. For all of the above reasons, Appellants respectfully request this Honorable Board to reverse the rejections of claims 1-17 and 33-36.

Respectfully submitted,

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9. CLAIMS APPENDIX

1. A method of making a reduced intensity hurricane, comprising:

positioning a plurality of submersibles in a hurricane interception area, the hurricane interception area describing an area of ocean through which at least a portion of the hurricane's central core will pass;

maneuvering the plurality of submersibles to a depth;

maintaining the plurality of submersibles in the hurricane interception area at the depth for a period of time; and

releasing a gas from the plurality of submersibles after the plurality of submersibles have entered the hurricane interception area, the gas being released during the period of time, the gas forming bubbles which rise in a plume toward a surface of the ocean, the plume entraining water from at least the depth and upwelling the entrained water toward the surface of the ocean to cool the surface of the ocean, the cooled surface reducing the intensity of the hurricane whose portion of central core passes through the hurricane interception area.

2. The method of claim 1, wherein the depth is greater than the depth of a thermocline below the surface of the ocean in the hurricane interception area.

3. The method of claim 1, wherein the period of time is in the range of about 3 to about 24 hours.

4. The method of claim 1, wherein the entrained water is upwelled at a rate, such that the total amount of upwelled water achieves a sea surface temperature reduction.

5. The method of claim 1, wherein a required cross track dimension of the interception area is substantially one half of the diameter of the hurricane's central core.

6. The method of claim 1, wherein the step of releasing occurs after the hurricane's intensification phase has ceased.

7. The method of claim 1, wherein the bubbles are formed at a diameter and rise from a release surface of a cross-sectional area.

8. A method of reducing the intensity of a hurricane, comprising:

staging a plurality of mobile submersibles in an interception area around a forecast hurricane position, the plurality of mobile submersibles distributed across a first distribution area comparable to a mean position forecast error of the forecast hurricane position;

reducing, in accordance with a reduced mean position forecast error as the hurricane approaches the plurality of mobile submersibles, the first distribution area of the plurality of mobile submersibles to a second distribution area; and

generating, after the step of reducing, at least one bubble plume from at least one of the plurality of mobile submersibles, the at least one bubble plume upwelling water from a depth to a surface of the ocean, the upwelled water cooling the surface of the ocean, the cooled

ocean surface reducing the intensity of the hurricane.

9. The method of claim 8, wherein the second distribution area is an area between about 30% to about 100% of the size of the hurricane's central core.

10. The method of claim 8, wherein the depth is greater than the depth of a thermocline below the surface of the ocean in the predetermined area.

11. The method of claim 8, wherein the bubble plume comprises bubbles formed at a diameter and rising from a release surface of a cross-sectional area.

12. The method of claim 8, wherein the upwelled water is upwelled at a rate, such that the total amount of upwelled water achieves a sea surface temperature reduction.

13. The method of claim 8, wherein the step of generating occurs after the hurricane's intensification phase has ceased.

14. A method of reducing the intensity of a hurricane, comprising:

positioning a plurality of submersibles below an ocean's surface in an area of the ocean above which at least a portion of the hurricane's central core will pass, the ocean's surface having a sea surface temperature;

generating at least one bubble plume from the plurality of submersibles; and

upwelling water by action of the at least one bubble plume, wherein the water is upwelled at a rate such that the total amount of upwelled water achieves a sea surface temperature reduction at the conclusion of a period of time.

15. The method of claim 14, wherein the plurality of submersibles are positioned below the ocean's surface at a depth greater than the depth of a thermocline.

16. The method of claim 14, wherein the portion of the hurricane's central core is between about 30% to about 100% of the size of the hurricane's central core.

17. The method of claim 14, wherein the period of time is in the range of about 3 to about 24 hours.

33. The method of claim 1, wherein the submersibles are stationary submersibles.

34. The method of claim 1, wherein the submersibles are mobile submersibles.

35. The method of claim 14, wherein the submersibles are stationary submersibles.

36. The method of claim 14, wherein the submersibles are mobile submersibles.

10. EVIDENCE APPENDIX

A copy of each of the following items of evidence relied on by the Appellant is attached:

A) U.S. Patent No. 6,315,213 (Cordani),

B) U.S. Patent No. 7,520,237 (Dimov Zhekov),

C) U.S. Pub. No. 2009/0173386 (Bowers et al.),

D) Atmocean Inc., "Atmocean," pages 1, http://www.atmocean.com,

E) Atmocean Inc., "Downsizing Hurricanes Using Atmocean's Upwelling System," pages 1, http://www.atmocean.com/hurricane_intensity.htm,

F) Rosenfeld, D. et al., "Simulation of Hurricane Response to Suppression of Warm Rain by Sub-Micron Aerosols," April 5, 2007, pages 3411-3424, Atmos. Chem. Phys., vol. 7, Copernicus Publications on behalf of the European Geosciences Union,

G) LaRosa, Richard, "Hurricane Suppression by Sea Surface Cooling," May 5, 2006, IEEE, page 5,

The evidence A-G was entered into the record by the Examiner in the October 13, 2009 Office Action.

H) Declaration Under Rule 132 of Neil Rondorf ("Rondorf Declaration") with enclosures,

I) Declaration Under Rule 132 of Vickie Singleton ("Singleton Declaration"), and

J) Declaration Under Rule 132 of Isaac Ginis ("Ginis Declaration").

The evidence H-J was entered into the record by the Examiner in the January 28, 2008 Office Action.

11. RELATED PROCEEDINGS APPENDIX

NONE